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(71) Applicant: **Gill's Cables Limited**
Packington Hall Tamworth Road
Lichfield, Staffs WS14 9PP(GB)

(72) Inventor: **Timpson, Ian Greville**
The Orchards Elford Road
Comberford Tamworth Staffordshire(GB)

(74) Representative: **Archer, Philip Bruce et al**
Urquhart-Dykes & Lord Trinity Court Trinity Street Priestgate
Peterborough Cambridgeshire PE1 1DA(GB)

(54) **Control cables.**

(57) An adjustment mechanism (48) for a control cable (16) operating a carburettor (12) from a driver's foot pedal (14) comprises a cable casing portion (50) on which an adjustment member (18) is slidable. The cable is initially set in an over-tensioned position relative to the adjuster. The foot pedal is then merely pushed to its limit position defined by a stop (40). The cable casing slides through the adjustor (18) in the tension-decreasing direction and the cable casing is then fixed in its adjusted position by frictional gripping of the adjustor on the casing assisted, if desired, by a manually inserted clip (66). The adjuster is arranged to slide on the cable casing at a load greater than the maximum load encountered during normal operation of the carburretor but less than the load which would damage the system.

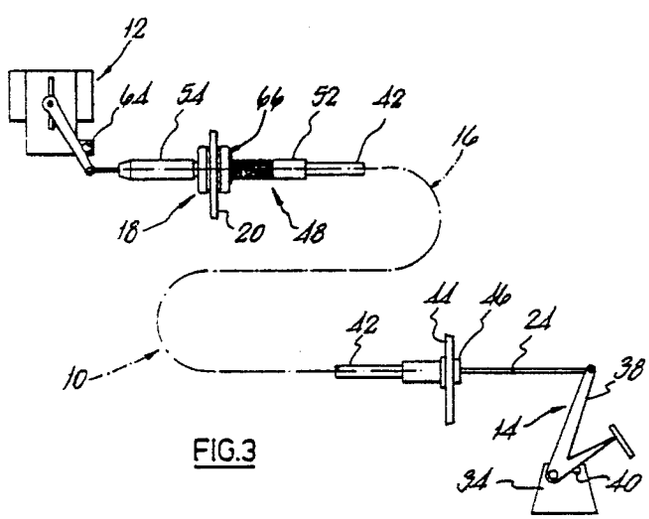

FIG.3

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CONTROL CABLES

This invention relates to control cables and methods of setting control cables in an adjusted condition between a cable actuator and a device controlled thereby. An example of the application of the invention is to a fuel supply control system for a motor vehicle, for example a throttle system in which a carburettor is controlled by a driver's foot pedal through a control cable. The invention may well be applicable to other uses of control cables.

In the case of control cables used in throttle systems for motor vehicles, in many cases the standard method of throttle adjustment usewd in the automobile industry comprises the following steps. Firstly, the cable is fitted between the driver's foot pedal and the carburettor control linkage. Secondly, the foot pedal is depressed and held at the limit of its travel. Thirdly, the cable is adjusted until the carburretor is set at the " wide-open " setting. Finally, the foot pedal is released. This method has two major drawbacks. Firstly, the pedal has to be depressed and locked before adjusting the cable. Secondly, proper adjustment of the system depends upon an operator making a critical adjustment on an assembly line. This often results in a maladjusted system which either cannot achieve "wide-open" throttle, or it results in overloading the system because the "wide-open" throttle position is reached before the pedal reaches its stop.

An object of the present invention is to provide a method and apparatus offering improvements in relation to one or more of these matters, or generally.

According to the invention there is provided a method of setting a control cable, and a control cable and an adjustment member therefor, as defined in the accompanying claims.

The invention also provides a control cable and a method of setting same not limited by all features of any one particular claim hereof, but comprising any novel combination of features disclosed herein which co-operate to provide any technical effect or advantage disclosed herein or which can be ascertained from the disclosure herein.

In an embodiment described below, a control cable comprises an adjustment mechanism in which a metal or plastic member is attached to the cable outer casing and may be formed with a series of annular grooves spaced apart along its length. On this cable member is positioned a flexible mounting or adjustment member made of rubber or suitable synthetic material of which the bore dimensions are suchthat a known load is required to slide the cable member through the adjustment member. This load is greater than the compressive load in the outer casing at the "wide-open" throttle setting, but is lower than the load which will overstress the throttle syetm.

In the embodiment, the cable is initially fitted with the adjustment member positioned at the end of the cable member at a position corresponding to over-adjustment in the tension-increasing direction. The adjustment of the system (in the direction of decreasing cable tension) is generally in accordance with the following. Firstly, the cable is fitted between the pedal actuator and the carburretor linkage using the adjustment member secured in a suitable bracket to locate one end of the cable outer casing. Then the operator depresses the pedal to the full extent of its travel, which automatically sets the system by moving the adjustment member lengthwise of the cable. A clip may then be inserted into the annular groove in the cable member which is adjacent to the back of the flexible adjustment member, so as to ensure that no movement of the adjustment member occurs in service.

In the embodiment, the correct setting is obtained because the initial position of the adjustemnt member ensures that the "wide-open" throttle position is achieved before the pedal reaches the full extent of its travel. At this point the load on the pedal is increased until the consequential compressive load in the cable outer casing is sufficient to slide the adjustment member over the cable member. The load on the pedal is maintained and the adjustment member continues to slide until the pedal reaches its stop. At this point the carburretor is still at "wide-open" throttle and the cable is now correctly adjusted. The pedal is then released. Wide-open throttle will now be achieved simultaneously with the pedal reaching its stop on future depressions of the pedal, and overloading of the system is prevented by the pedal stop itself.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Fig.l shows a side elevation view of an end portion of the casing of a control cable according to the invention together with an adjustment member mounted thereon for the purpose of the invention;

Fig.2 shows the casing and adjustor of Fig.l connected to a support, there being also shown the internal control cable connected between the carbvrretor of a motor vehicle, and a driver's foot pedal for controlling same; and

Fig.3 shows the assembly of Fig.2 (which latter is in its pre-adjustment condition), after the system has been adjusted by depressing the foot pedal to the limit of its downward travel.

As shown in the drawings, a system 10 for controlling the carburretor 12 of a motor vehicle by means of a driver's foot pedal 14 comprises a control cable 16 interconnecting the foot pedal and the carburettor and connected by an adjustemnt member 18 to a fixed support 20, for a purpose to be described.

Carburettor 12 is shown somewhat diagrammatically. It comprises a control lever 22 connected to the internal cable 24 of control cable 16 and pivotted at 26.

The inner cable core 24 of cable 16 is connected at 28 to the actuating lever 30 of pedal 14, which latter is pivotted at 32 on a support 34. A pedal plate 36 is mounted on a primary actuator lever arm 38 formed integrally with arm 30 and engageable with a fixed stop 40 mounted on support 34, to limit the travle of actuator 14.

Cable 16 comprises a tubular outer casing 42 through which cable core 24 slidingly extends between the carburettor control lever 22 and actuator 14.Casing 42 is secured at the end in the region of actuator 14 to a fixed support 44 by means of an end fitting 46 fixed to the casing. At the other end of the casing, in the region of carburretor 12, there is provided adjustment means 48, which will now be described.

Adjustment means 48 comprises a casing end portion or sleeve 50 fixed to the end of the primary casing portion 42 and through which cable core 24 freely and slidingly extends. The casing portion 50 comprises plain end portions 52,54 separated by a ribbed portion 56. On the ribbed portion there are formed a series of closely spaced annular ribs separated by respective grooves. Each rib is of rectangular cross-sectional shape and encircles the casing and is separated from its adjacent ribs by corresponding grooves of widths similar to the ribs. These details are more readily seen in Fig.1.

Adjustment member 18 is slidingly received on casing portion 50. As shown in Fig.1, adjustment member 18 is generally in the form of a grommet having end flange portions 58,60 separated by a reduced diameter land 62, the whole being formed as an integral moulding of natural or synthetic rubber, or other elastomer, or from an alternative polymer such as PVC. The adjustment member has a central circular opening in which casing portion 50 is slidably received.

It is particularly to be noted that the external dimensions of casing portion 50 and the internal dimensions of the aperture formed in adjustment member 18 are carefully chosen so that the adjustment member has particular frictional sliding characteristics. These characteristics permit lengthwise sliding movement of the adjustment member with respect to casing portion 50, in accordance with the following parameters. Firstly, the thrust needed to adjust member 18 lengthwise of cable portion 50 is greater than that required to actuate carburretor 12. Also, it is less than that which would damage cable 16 or the mechanisms connected to it. Moreover, the load or thrust required to shift adjustment member 18 lengthwise of casing portion 50 is also greater than the load or thrust which occurs during kickdown on a vehicle having an automatic transmission. Kickdown relates to the technique for manually causing an automatic transmission to change to a condition for the transmission of higher torque, this being achieved by a jab applied to the throttle control system by the driver's foot. The load thus applied is usually in the range of 10 to 20% above the normal maximum load applied to the cable at full throttle. In his embodiment, where a twin carburretor is employed, a force of about 65 newtons is required to achieve the full throttle condition and it is arranged that a force of 80 to 90 newtons is needed to shift the adjustment member 18 with respect to the cable casing. The load required to actuate carburretors varies from manufacturer to manufacturer. Thus , for example, one motor vehicle manufacturer fits carburretors requiring a force of about 80 to 90 newtons to achieve full throttle. However, the majority of carburretors require a force only of 35 to 40 newtons. Often, it is arranged that the force required for adjustment is in the range of 10 to 20 newtons above the force required to achieve wide-open throttle. For most applications relating to motor vehicle carburretors and the like a force in the range of 40 to 150 newtons will be required to effect adjustment of the adjustment member relative to the cable casing. However, a safety margin of about 20 newtons should preferably be allowed to compensate for the presence of oil or grease on the cable during use -in other words, the force required to achieve adjustment is increased by this amount.

In use, the system is initially set up in the condition as shown in Fig.2 with adjustment member 18 in the over-adjusted end position corresponding to excessive tension in the cable core 24. As can be seen in Fig.2, the carburretor is in its less than fully closed position when foot pedal 14 is in its released condition.

To adjust cable 16 all that is required is for an operative to depress pedal 14 as shown in Fig.3. What happens is that the carburretor lever 22 is swung anticlockwise as seen in the drawings until it engages its end stop 64, whereupon the load in the cable 16 rises to a level at which adjustment member 18 can slide lengthwise of the cable casing portion 50. As shown in Fig.3 the cable casing slides through the adjustor to the position shown in Fig.3 in which the adjustment member is positioned on rib portion 56 of the casing. This is the correctly adjusted position in which foot pedal 14 is

engaging its end stop 40, and so too is the carburretor lever 22. The latter reaches its end stop 64 before the pedal reaches stop 40. Then, the final travel of the foot pedal causes adjustment of the cable casing portion 50 through adjustment member I8, as described above. After that, a retaining clip 66 can be inserted behind adjustment member I8 to engage between the ribs and grooves of portion 56 and thereby lock the adjustment member in its properly adjusted position. It will be understood that in the normal working life of a device of this kind, adjustment of the cable with respect to the fixed support 20 in the manner described above may only occur once, though manual adjustment to take up wear may be subsequently effected by pulling the cable through adjustment member I8 and re-applying clip 66, if the latter is used. It should be noted that the rubber adjustment member I8 serves to isolate the throttle pedal I4 from engine vibration, which is a valuable second facility provided by this component.

Amongst other modifications which could be made in the above embodiment while remaining within the scope of the invention are the following. In place of the grooved cable casing portion 50, in which the adjustment member I8 moves, in use, from groove to groove, it would be possible to use an ungrooved structure, or indeed to provide alternative surface formations , including such formations provided within the adjustment member itself. Moreover the adjustment member may be formed from suitable synthetic materials other than rubber and like polymers. The adjustment member should preferably be of a flexible material since this tends to avoid over-adjustment. As the member moves from groove to groove, its flexibility and/or resilience tends to cause it to move backwards (in the cable-tensioning direction) when it comes to rest.

The adjustment member I8 can be set in its overadjusted position either before assembly or after. This member can be of various forms and need not necessarily be in the form of a collar. Prior art adjustment members have tended to be of a form and nature similar to clip 66, effectively fixing the cable relative to its support.

Claims

I. A method of setting a control cable comprising the step of setting a cable actuator to a predetermined position and setting an adjuster relative to the cable, characterised by employing the load produced in the cable by aid setting of the cable actuator, to move said adjuster lengthwise of the cable to an adjusted position.

2. A method of setting a control cable in an adjusted condition between a cable actuator and a device controlled thereby, the method comprising the steps of:

a) providing said cable comprising inner and outer members for connection between said actuator and said device, and providing also an adjustment member which is mountable on said cable, said adjustment member being connectible to the cable at chosen positions along the length of the cable to adjust same; and

b) connecting said cable between said actuator and said device and adjusting same by position-adjusting the cable relative to a mounting therefor by means of said adjuster

characterised in that

said adjustment member is connectible to said cable at chosen positions along the length thereof by position-adjustment lengthwise of the cable, and requires the application of a defined load between the adjustor and the cable to achieve said position-adjustment;

said defined load being greater than the maximum load required to actuate said device;

said method being further characterised by the step of setting the adjuster relative to the cable in a position corresponding to the cable being over-adjusted in the direction of increasing the tension therein; and

subsequently moving said cable actuator to a predetermined position to increase the tension in said cable and to adjust said adjustment member lengthwise of the cable in the direction of decreasing tension in the cable, to an adjusted position corresponding to said predetermined position of the actuator.

3. A method according to claim 2 characterised by said predetermined position of said actuator being the limit position thereof in the direction of increasing cable load.

4. A method according to claim 3 characterised by said adjuster comprising a resilient material which resiliently deforms at least slightly under said defined load whereby said step of position-adjusting said adjustment member lengthwise of the cable in the direction of decreasing cable tension is automatically followed by a slight increase in tension caused by elastic recovery of said adjustment member.

5. A control cable and an adjustment member therefor characterised in that said cable and said member are capable of being set in an adjusted condition by a method according to any one of the preceding claims.

6. A control cable according to claim 5 characterised in that said adjustment member frictionally grips said cable.

7. A control cable according to claim 6 characterised in that said adjustment member and/or said cable are formed with surfaces for mutual frictional engagement.

8. A control cable according to claim 7 characterised in that said adjustment member is in the form of a collar of a resilient material adapted to frictionally engage and grip the outer casing of said cable.

9. A control cable according to claim 8 characterised in that said cable has longitudinally spaced formations such as ribs whereby adjustment of said adjustment member lengthwise of the cable is at least partially stepwise.

10. An automobile engine control system comprising a control cable and an adjustment member therefor as claimed in any one of claims 5 to 9.

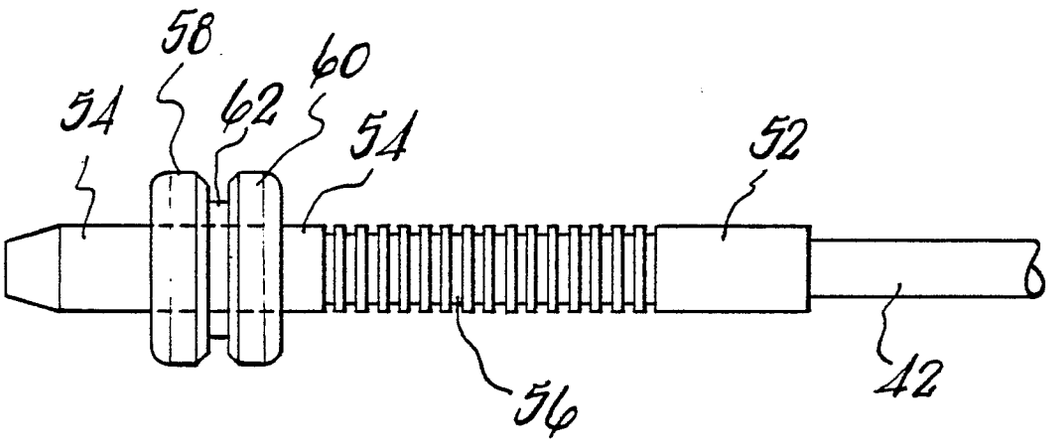

FIG.1

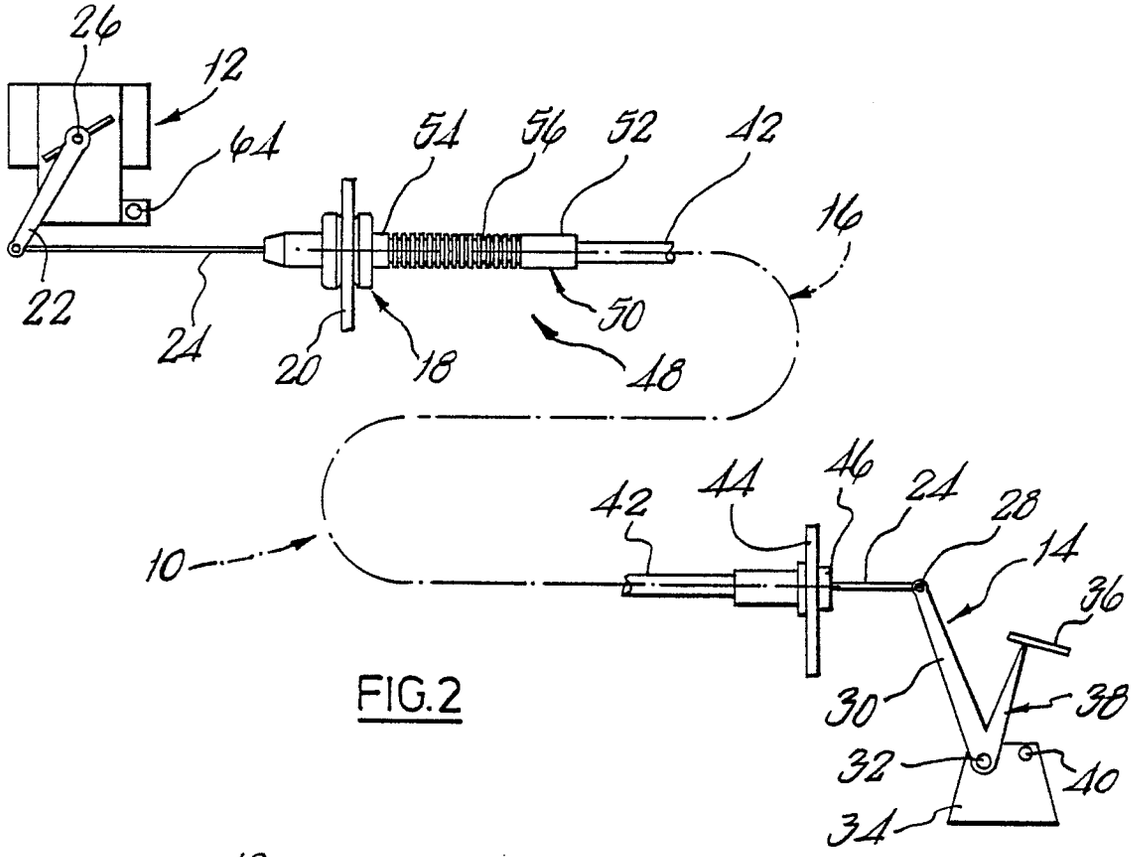
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FIG.2

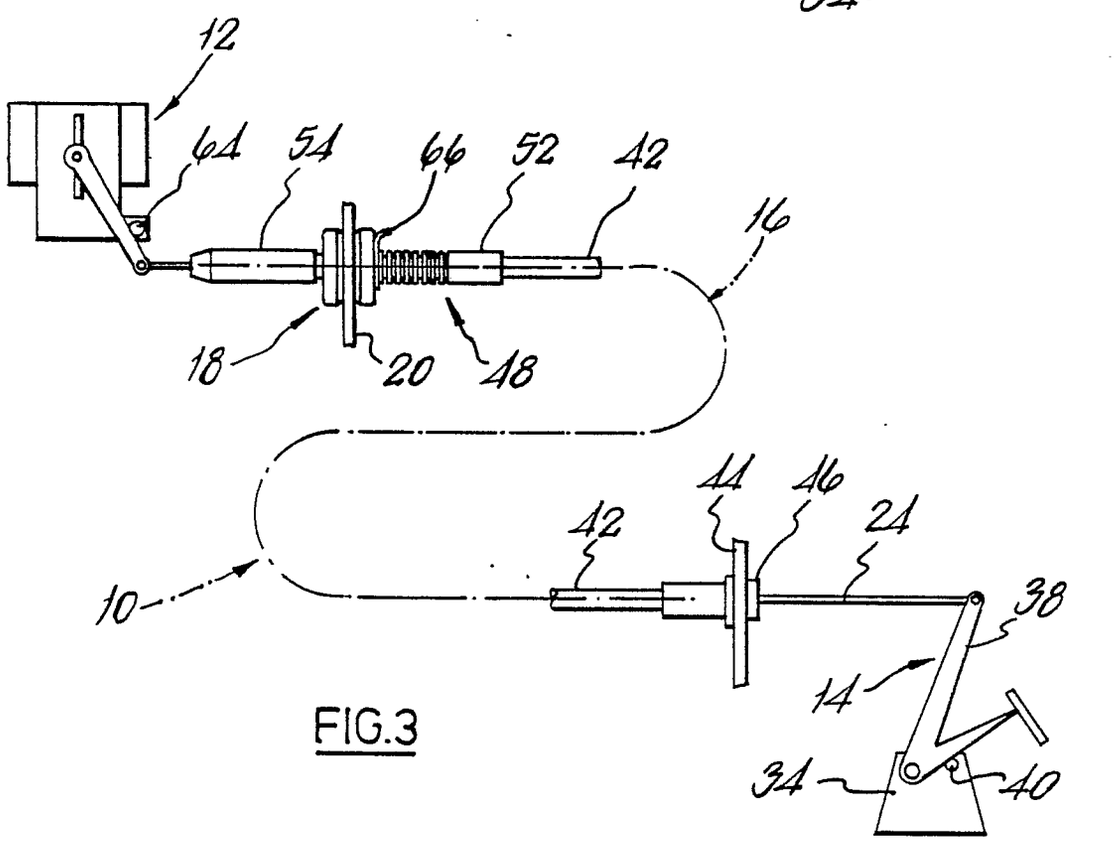
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FIG.3

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EUROPEAN SEARCH REPORT

Application number

EP 87 30 5407

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl 4)
X	GB-A-2 081 411 (FORD) * whole document *	1-3,5	F 16 C 1/22 B 60 K 26/04
A		6-9	

X	US-A-3 662 617 (BENNETT et al.) * whole document *	1-3,5	

X	EP-A-0 183 338 (TELEFLEX) * claim 1; figure 2 *	1-3,5	

A	DE-B-2 237 301 (GENERAL MOTORS) * column 4, lines 25-64; figures 2, 3 *	1-8	

TECHNICAL FIELDS SEARCHED (Int. Cl 4)

F 16 C 1/00
B 60 K 26/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	16-09-1987	KRIEGER P O

CATEGORY OF CITED DOCUMENTS

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